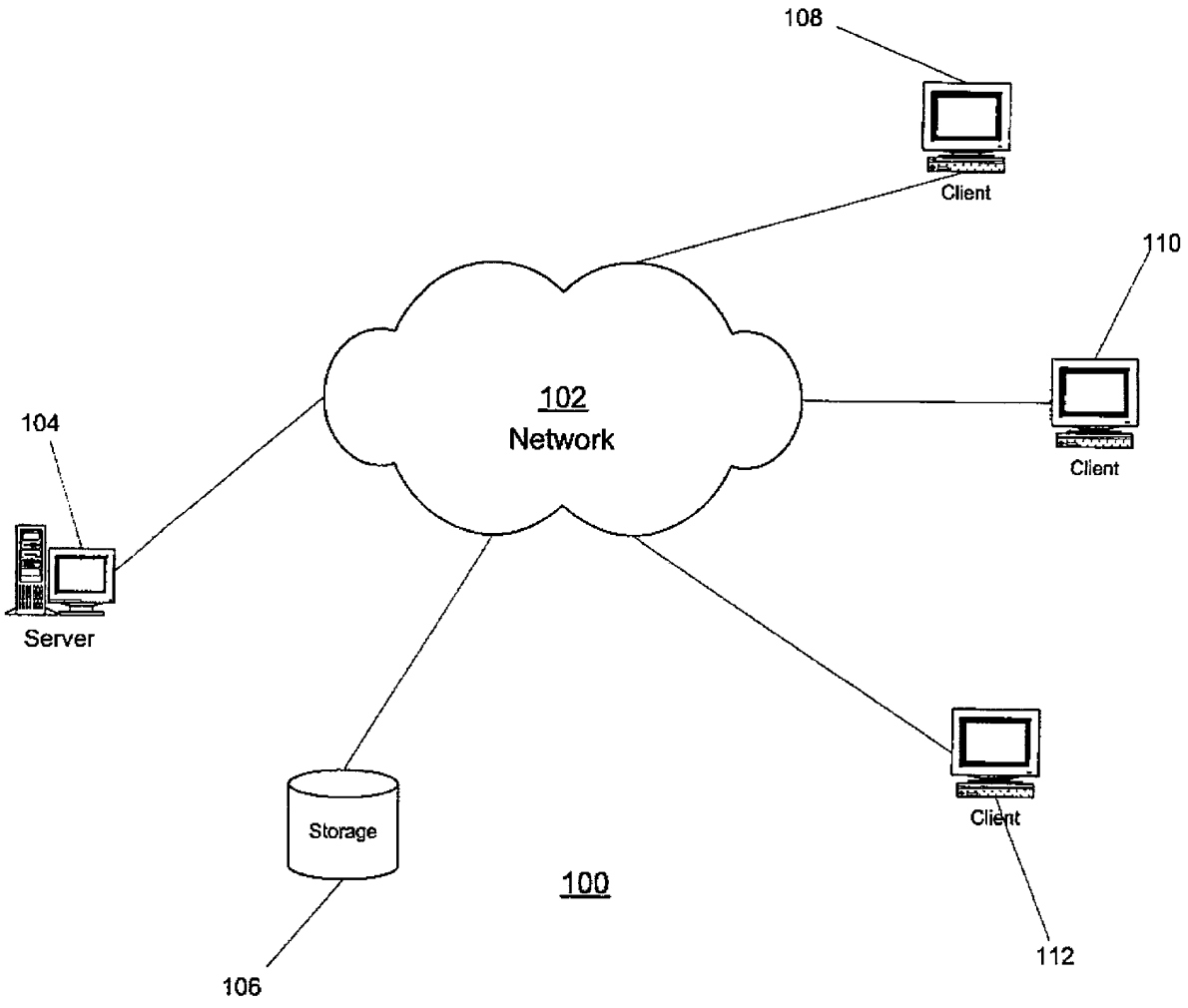
Figure 1

Koved et al.
AUS920010942US1
Method and Apparatus for Implementing
Permission Based Access Control
Through Permission Type Inheritance



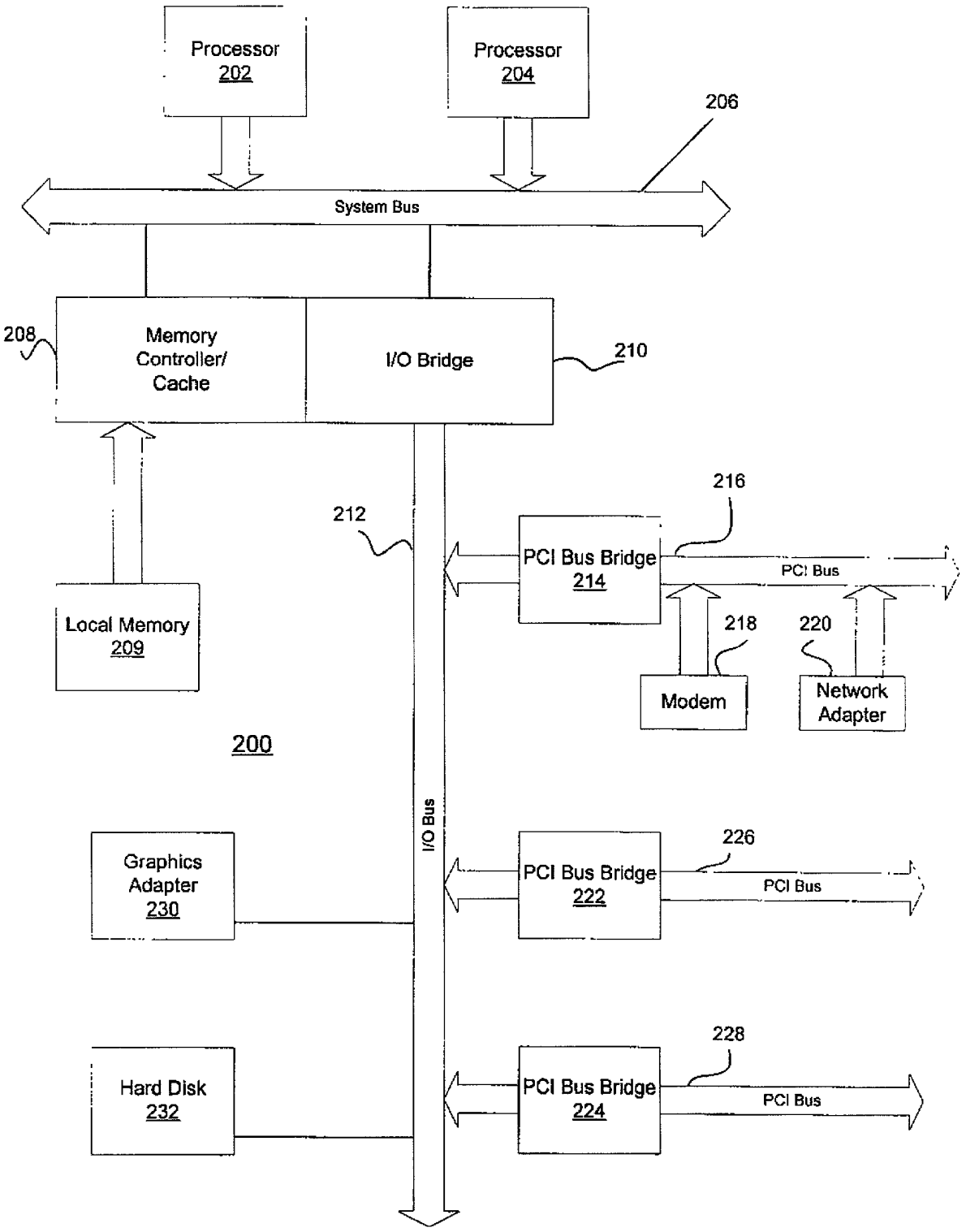

Processor
202
Processor
204
206
System Bus
208
Memory
Controller/
Cache
I/O Bridge
210
212
216
PCI Bus Bridge
214
PCI Bus
Local Memory
209
218
220
Modem
Network
Adapter
200
I/O Bus
Graphics
Adapter
230
226
PCI Bus Bridge
222
PCI Bus
Hard Disk
232
228
PCI Bus Bridge
224
PCI Bus

Figure 2

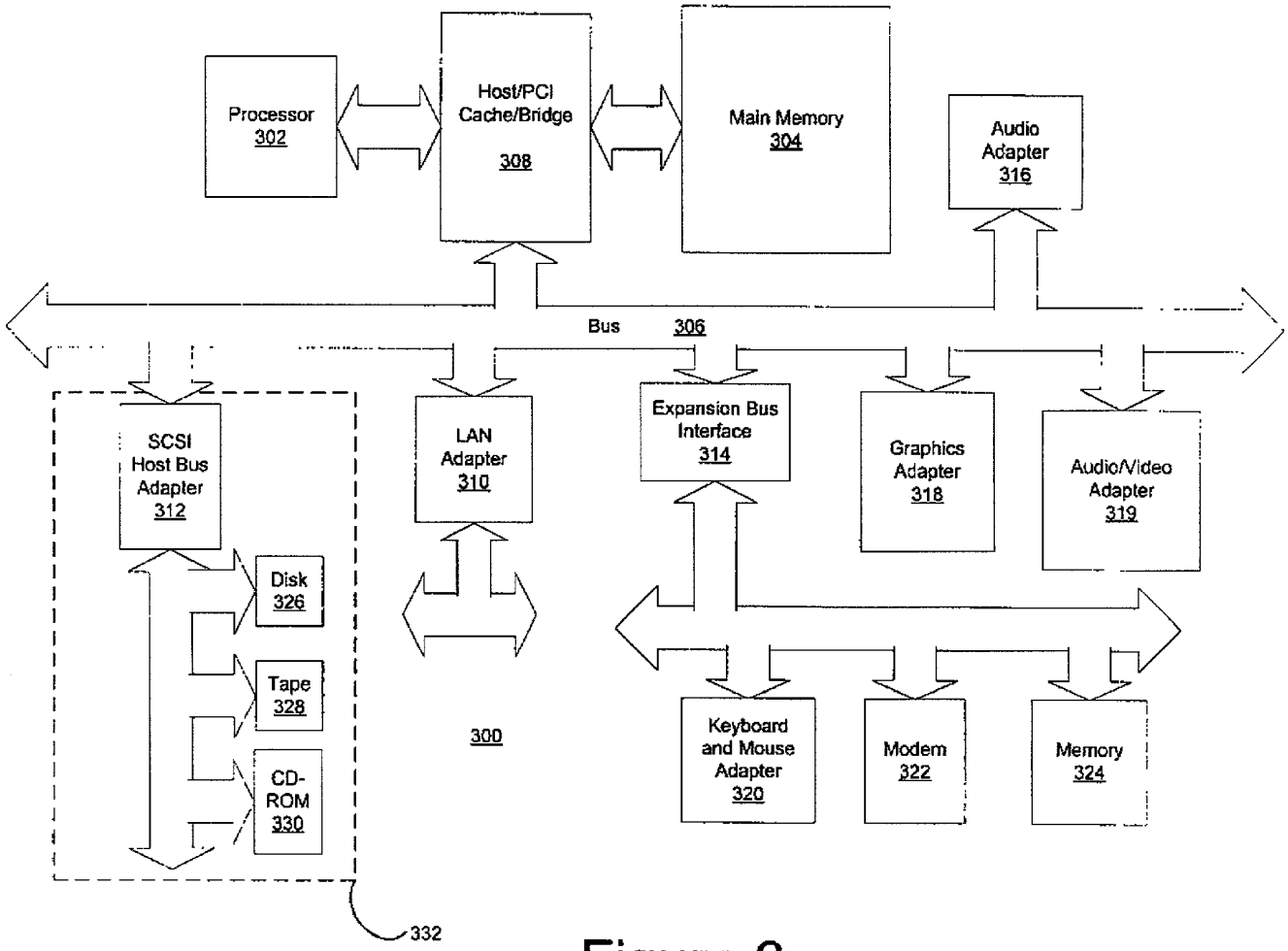

Processor
302
Host/PCI
Cache/Bridge
308
Main Memory
304
Audio
Adapter
316
Bus
306
SCSI
Host Bus
Adapter
312
LAN
Adapter
310
Expansion Bus
Interface
314
Graphics
Adapter
318
Audio/Video
Adapter
319
Disk
326
Tape
328
CD-
ROM
330
300
Keyboard
and Mouse
Adapter
320
Modem
322
Memory
324
332

Figure 3

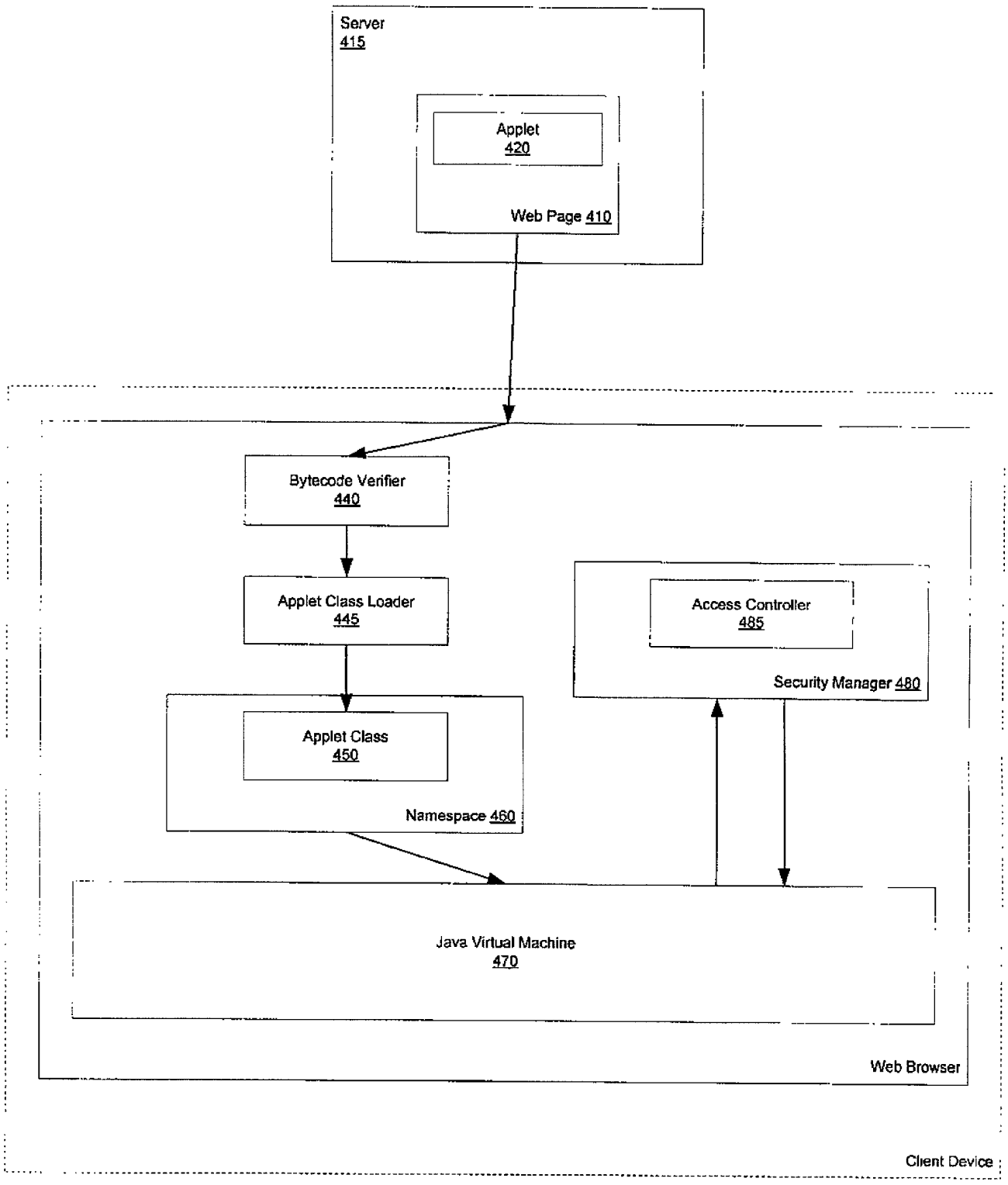

Server
415
Applet
420
Web Page 410
Bytecode Verifier
440
Applet Class Loader
445
Applet Class
450
Namespace 460
Access Controller
485
Security Manager 480
Java Virtual Machine
470
Web Browser
Client Device

Figure 4

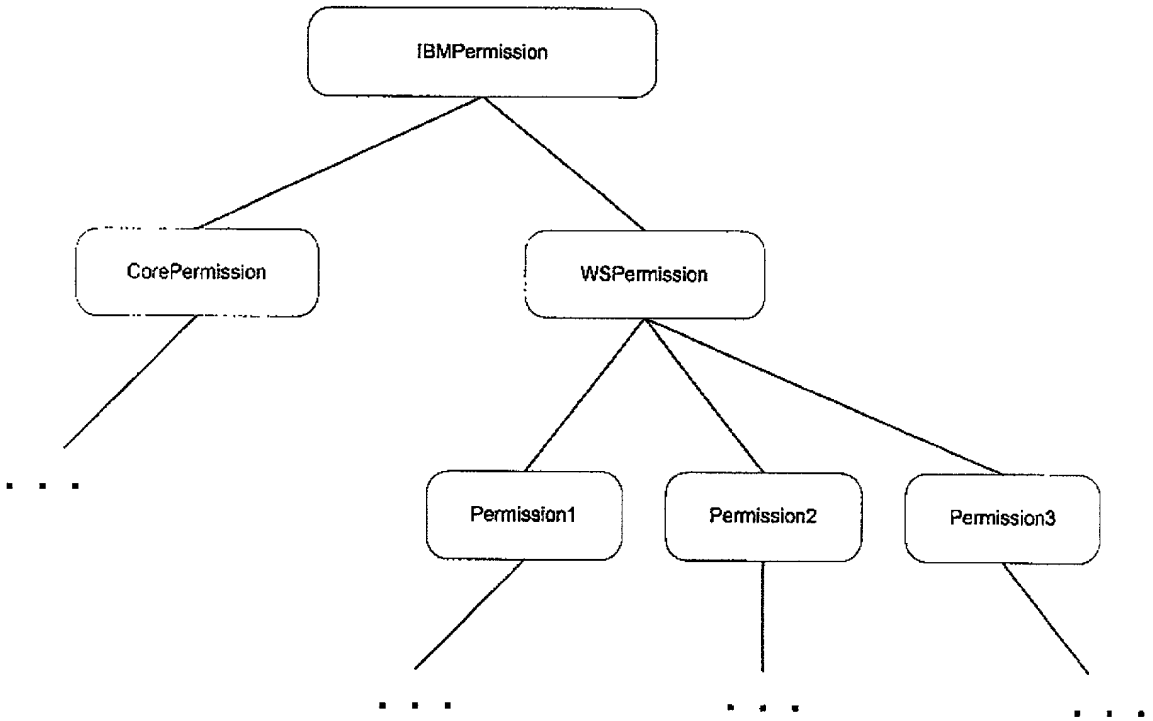

IBMPermission
CorePermission
WSPermission
Permission1
Permission2
Permission3

Figure 5

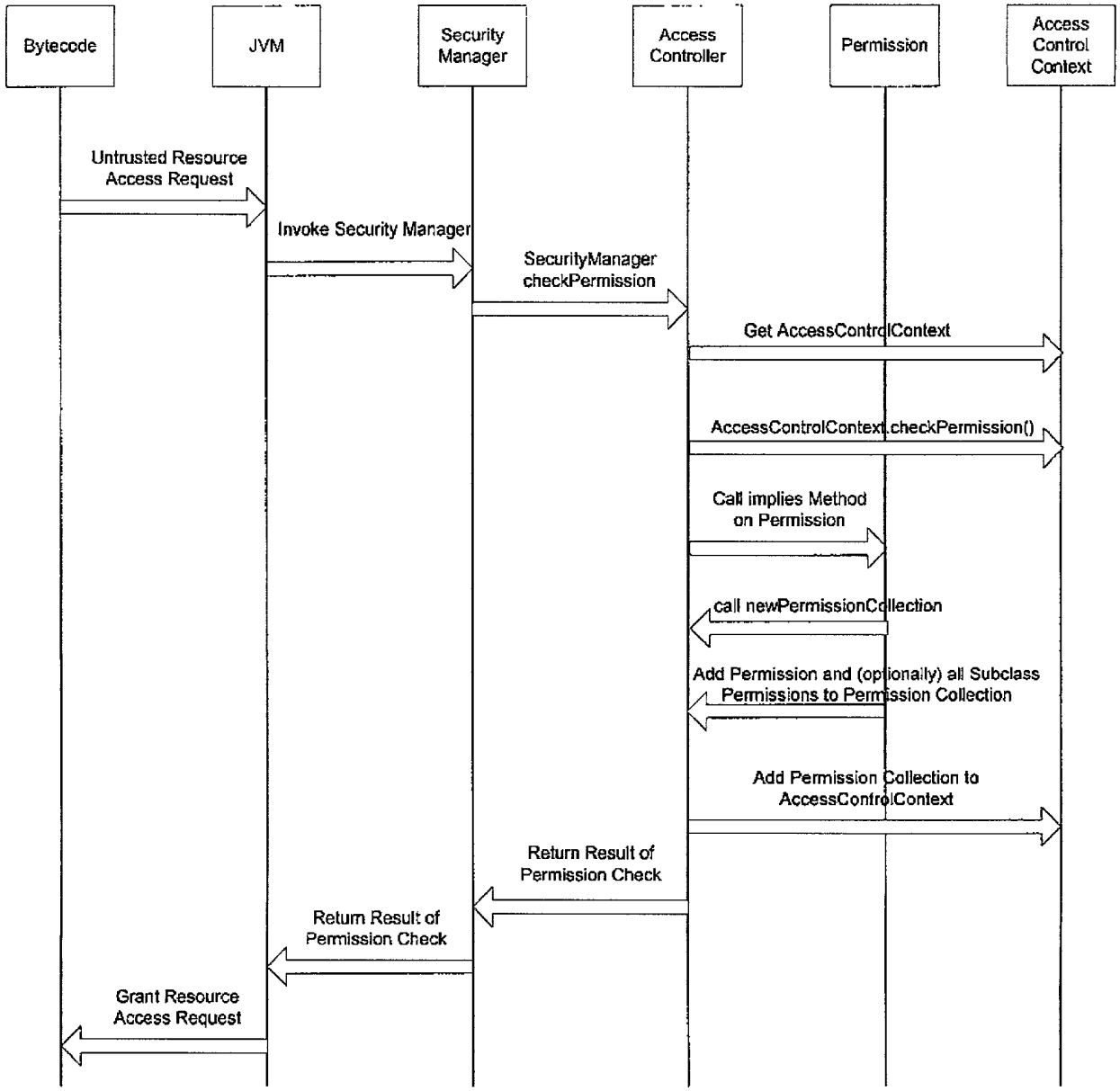

Bytecode
JVM
Security Manager
Access Controller
Permission
Access Control Context
Untrusted Resource Access Request
Invoke Security Manager
SecurityManager checkPermission
Get AccessControlContext
AccessControlContext.checkPermission()
Call implies Method on Permission
call newPermissionCollection
Add Permission and (optionally) all Subclass Permissions to Permission Collection
Add Permission Collection to AccessControlContext
Return Result of Permission Check
Return Result of Permission Check
Grant Resource Access Request

Figure 6

```
import java.security.BasicPermission;
import java.security.Permission;
import java.security.PermissionCollection;
import java.util.Hashtable;
import java.util.Enumeration;

public class IBMPermission extends BasicPermission
{
        public IBMPermission()
        {
                super("");
                System.out.println("Constructor IBMPermission() called");
        }
        public IBMPermission(String target)
        {
                super(target);
                System.out.println("Constructor IBMPermission(target) called");
        }

        public IBMPermission(String target, String actions)
        {
                super(target, actions);
                System.out.println("Constructor IBMPermission(target, actions) called");
        }
        public boolean implies(Permission perm)
        {
                System.out.println("IBMPermission.implies() called");

                if (perm instanceof IBMPermission)
                        return true;
                return false;
        }
        public PermissionCollection newPermissionCollection()
    {
                return new IBMPermissionCollection();
    }
}
```

Figure 7A

```
final class IBMPermissionCollection extends PermissionCollection
       implements java.io.Serializable
{
    private Hashtable permissions;

    public IBMPermissionCollection()
    {
              permissions = new Hashtable();
    }

    public void add(Permission permission)
    {
              if (! (permission instanceof IBMPermission))
                  throw new IllegalArgumentException("Invalid Permission: " +
                                                                          permission);

              IBMPermission ibmp = (IBMPermission) permission;
              permissions.put(ibmp.getName(), permission);
    }

    public boolean implies(Permission permission)
    {
              if (! (permission instanceof IBMPermission))
                     return false;

              System.out.println("permission instanceof IBMPermission == true");

              IBMPermission ibmp = (IBMPermission) permission;
              String permName = ibmp.getName();
              Permission x = (Permission) permissions.get(permName);

              if (x != null)
              {
                  System.out.println("We have a direct hit! " + x.getName());
                  return x.implies(permission);
              }

              Enumeration permEnum = permissions.elements();

              while (permEnum.hasMoreElements())
              {
                     x = (IBMPermission) permEnum.nextElement();
                     System.out.println(x.getName());

                     if (x.implies(permission))
                            return true;
              }

              return false;
       }

    public Enumeration elements()
    {
              return permissions.elements();
    }
}
```

Figure 7B

```
import java.security.PermissionCollection;
import java.security.AccessController;
import java.security.AccessControlContext;
import java.security.AccessControlException;

public class WSPermission extends IBMPermission
{
        public WSPermission(String target)
        {
                super(target);
                System.out.println("Constructor WSPermission(target) called");
        }

        public WSPermission(String target, String actions)
        {
                super(target, actions);
                System.out.println("Constructor WSPermission(target, actions) called");
        }

        public WSPermission()
        {
                super("");
                System.out.println("Constructor WSPermission() called");
        }

    /**
     * Returns a new IBMPermissionCollection object for storing IBMPermission
     * objects.
     * <p>
     * An IBMPermissionCollection stores a collection of
     * IBMPermission permissions.
     * <p>
     * IBMPermission objects must be stored in a manner that allows them
     * to be inserted in any order, but that also enables the
     * PermissionCollection <code>implies</code> method
     * to be implemented in an efficient (and consistent) manner.
     *
     * @return a new IBMPermissionCollection object suitable for
     *             storing IBMPermission's.
     */
        public PermissionCollection newPermissionCollection()
    {
                System.out.println("newPermissionCollection() was called");
                IBMPermissionCollection ibmPC = new IBMPermissionCollection();

                // the code here checks if an IBMPermissionCollection has been granted.
                // If yes, then the PermissionCollection returned by this
                // method should contain a WSPermission.

                AccessControlContext acc = AccessController.getContext();

                try
                {
                        acc.checkPermission(new IBMPermission("PermissionTest"));
                        ibmPC.add(new WSPermission("PermissionTest"));
                }
                catch (AccessControlException ace)
                {
                        System.out.println("IBMPermission WAS NOT GRANTED");
                }
                return ibmPC;
    }
}
```

Figure 7C

```
import java.io.*;

public class PermissionTest
{
      public static void main(String args[])
      {
            try
            {
                  SecurityManager sm = System.getSecurityManager();

                  if (sm != null)
                  {
                        System.out.println("SecurityManager is checking for " +
                                                "WSPermission");

                        sm.checkPermission(new WSPermission("PermissionTest"));
                  }

                  System.out.println("WSPermission was granted. " +
                                          "Permission testing
worked.\n\n\n");

                  File inputFile = new File("C:\\winzip.log");
                  FileInputStream fis = new FileInputStream(inputFile);
                  InputStreamReader isr = new InputStreamReader(fis);
                  BufferedReader br = new BufferedReader(isr);

                  String lineRead;
                  while ((lineRead = br.readLine()) != null)
                        System.out.println(lineRead);
            }

      catch(Exception e)
      {
                  e.printStackTrace();
      }
      }
}
```

Figure 8

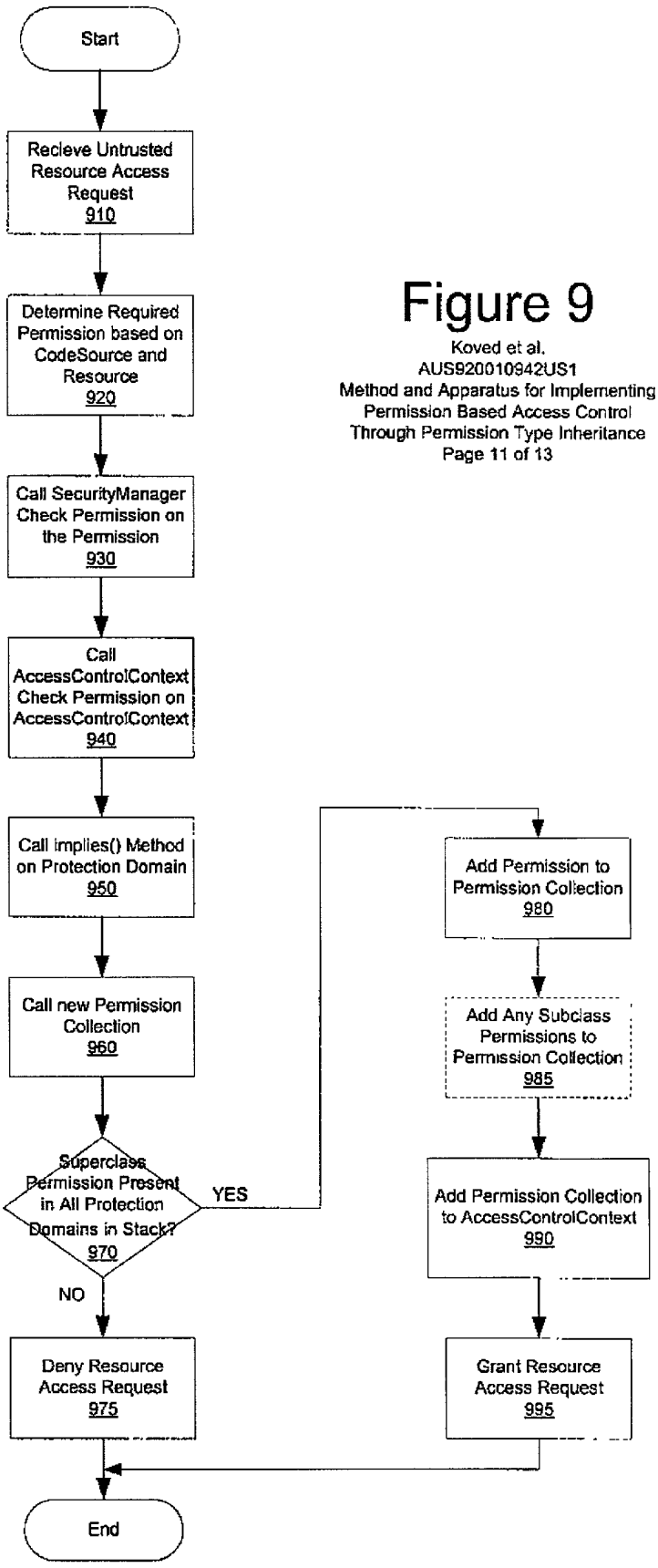


Figure 9

Koved et al.
AUS920010942US1
Method and Apparatus for Implementing Permission Based Access Control Through Permission Type Inheritance
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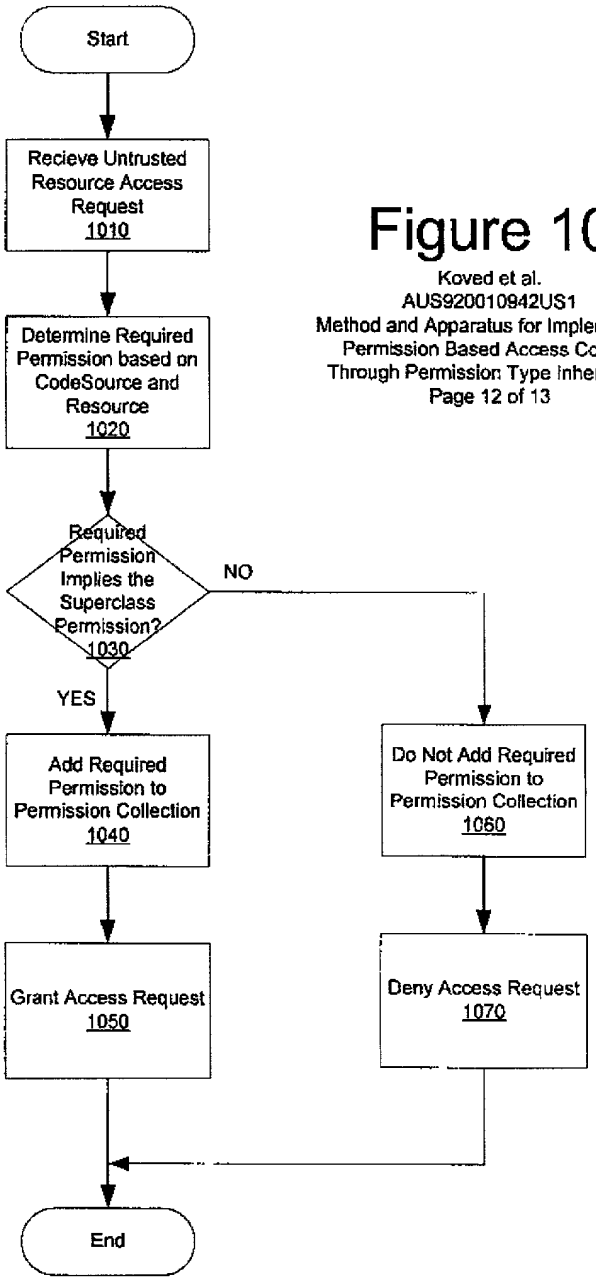
Start
Recieve Untrusted Resource Access Request 1010
Determine Required Permission based on CodeSource and Resource 1020
Required Permission Implies the Superclass Permission? 1030
NO
YES
Add Required Permission to Permission Collection 1040
Do Not Add Required Permission to Permission Collection 1060
Grant Access Request 1050
Deny Access Request 1070
End

Figure 10

```
package sun.security.provider;

import java.security.PermissionCollection;
import java.security.CodeSource;
import IBMPermission;
import WSPermission;

public class MarcoPolicy extends PolicyFile
{
      public PermissionCollection getPermissions(CodeSource codesource)
      {
            PermissionCollection pc = super.getPermissions(codesource);

            if (pc == null)
                  return null;

            if (pc.implies(new IBMPermission("PermissionTest")))
                  pc.add(new WSPermission("PermissionTest"));

            return pc;
      }
}
```

Figure 11